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# LAND & BUILDINGS AT LOW FARM, BRIDGE ROAD, BROMESWELL, SUFFOLK

## DETAILED MAGNETOMETER SURVEY



Report Number: 1003

July 2012

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**LAND & BUILDINGS AT LOW FARM, BRIDGE ROAD,  
BROMESWELL, SUFFOLK**

**Detailed Magnetometer Survey**

Prepared for:  
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July 2012

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<b>Planning Ref.</b>	C/12/0683	<b>OASIS</b>	britannia1-129836
<b>Approved By</b>	<b>Matthew Adams</b>	<b>DATE</b>	
			July 2012

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## Abstract

Despite the high potential for anomalies of archaeological origin, only two curvilinear and one discrete pit type anomaly were present at Low Farm. Extant agricultural furrows were recorded to the south-west and areas of magnetic disturbance and iron-spike anomalies were abundant across large parts of the survey area alluding to the widespread modern agricultural activity and landscaping undertaken during recent years.

## 1.0 INTRODUCTION

On the 29<sup>th</sup> July 2012 Britannia Archaeology Ltd (BA) undertook detailed magnetometer survey on land at Low Farm, Bridge Road, Bromeswell Suffolk (TM 307 515) in advance of the construction of a ground mounted photovoltaics (PV) system. The survey was undertaken on behalf of Ruth Goodfield of Mosscliff Environmental Ltd in response to a brief (dated 25<sup>th</sup> June 2012) prepared by Dr Jess Tipper of Suffolk County Council Archaeological Service Conservation Team (SCCAS/CT) on c.1ha of agricultural land.

## 2.0 SITE DESCRIPTION

The PV array will be positioned on land currently used for agriculture in the south eastern corner of the field, bounded by Bridge Road to the east and Summer Lane to the south (see Figure 1). It is estimated that the supports will be bored to a depth of 1m and are 0.30m in width. The survey area is located on a plateau to the south-east which slopes quite considerably from the centre of the site in a northerly direction.

Ground conditions were good for magnetometer survey, the field was ploughed and harrowed with furrows present only in the western corner. Two aluminium poles were present marking out the corner of the PV array. The slurry pit, landscaped new tree plantation and some farm equipment were the only site furniture that have caused issues regarding the dataset (see Figure 1).

The Bedrock comprises Red Crag Formation sand, a sedimentary bedrock formed c.2 – 4 million years ago in the Neogene Period when the local environment was dominated by shallow seas. The overlying superficial geology is Lowestoft Formation sand and gravel, deposits formed up to 2 million years ago in the Quaternary Period when the local environment was dominated by ice age conditions, with glaciers scouring the landscape and depositing moraines of till, outwash sand and gravel.

## 3.0 PLANNING POLICIES

The archaeological investigation was carried out on the recommendation of the local planning authority, following guidance laid down by the National Planning and Policy Framework (NPPF, DCLD 2012) which replaces Planning Policy Statement 5: Planning for the Historic Environment (PPS5, DCLG 2010). The relevant local planning policies also include the Suffolk Coastal Local Plan (2nd Amendment March 2006): Policy AP7.

### 3.1 *National Planning Policy Framework (NPPF, DCLG March 2012)*

The NPPF recognises that 'heritage assets' are an irreplaceable resource and planning authorities should conserve them in a manner appropriate to their significance when considering development. It requires developers to record and advance understanding of the significance of any heritage assets to be lost (wholly or in part) in a manner



proportionate to their importance and the impact, and to make this evidence (and any archive generated) publicly accessible. The key areas for consideration are:

- The significance of the heritage asset and its setting in relation to the proposed development;
- The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance;
- Significance (of the heritage asset) can be harmed or lost through alteration or destruction, or development within its setting. As heritage assets are irreplaceable, any harm or loss should require clear and convincing justification;
- Local planning authorities should not permit loss of the whole or part of a heritage asset without taking all reasonable steps to ensure the new development will proceed after the loss has occurred;
- Non-designated heritage assets of archaeological interest that are demonstrably of equivalent significance to scheduled monuments, should be considered subject to the policies for designated heritage assets.

### 3.2 *Suffolk Coastal Local Plan (2nd Amendment March 2006): Policy AP7*

Suffolk Coastal's current Local Development Plan was adopted in March 2006 following a second amendment to the original 1994 plan. It is due to be replaced by a Local Development Framework shortly. The Council's current position on heritage assets is stated in Policy AP7 and is summarised as follows:

- for development(s) that might affect sites that are known or are likely to contain archaeological remains, the Council will require, where necessary, a professional archaeological assessment as to the likelihood that remains might be encountered and their importance;
- On the basis of the assessment, a professional field evaluation should be conducted in cases where the assessment suggests that important archaeological remains may exist but it is unable to be precise about their nature or extent;
- Preservation of archaeological remains in situ where the assessment and/or field evaluation indicate that the remains are important. Even where lesser remains exist, consideration must be given to the desirability of preserving them in situ.

## 4.0 **ARCHAEOLOGICAL BACKGROUND**

The site is located in an area of archaeological importance recorded in the County Historic Environment Record as an Iron Age settlement (HER BML013 and BML004). Therefore there is a high potential for heritage assets and archaeological remains to be encountered during groundwork's.



## 5.0 PROJECT AIMS

This specific aim of the geophysical survey was to enable the archaeological resource, both in quality and extent, to be accurately quantified to help inform any subsequent phases of archaeological mitigation.

## 6.0 METHODOLOGY

### 6.1 Instrument Type Justification

#### *Bartington DualGrad 601-2*

Britannia Archaeology Ltd employed a Bartington Dual Grad 601-2 fluxgate gradiometer to undertake the survey, because of its high sensitivity and rapid ground coverage. The soils and underlying geology were receptive to gradiometer survey.

### 6.2 Instrument Calibration

The DualGrad 601-2 was left on for a minimum of 20 minutes in the morning for the sensors to settle before any recorded survey took place. The instrument was zeroed after every three grids to minimise the effect of sensor drift. An area chosen with low magnetic susceptibility to calibrate the instruments sensors was located, this same point was then used to zero the sensors throughout the survey providing a common zero point.

### 6.3 Sampling Interval and Grid Size

The magnetometer survey was undertaken with a sampling interval of 0.25m along 1m traverse intervals, within a 20 x 20m grid.

### 6.4 Survey Grid Location

The survey grid was set out to the Ordnance Survey OSGB36 datum to an accuracy of  $\pm 0.01\text{m}$  employing a Leica Glonnass Smart Rover (see Figure 1). Data was converted to the National Grid Transformation OSTN02, and the instrument was regularly tested using stations with known ETRS89 coordinates.

### 6.5 Data Capture

Instrument readings were recorded on an internal data logger which were downloaded to a laptop at midday and at the end of the survey. The grid order was recorded on a BA pro-forma (see Figure 2) to aid in the creation of the composite data. Data were filed in job specific folders and broken up into individual field composite data sets (see Figures 3-6). These data composites were checked for quality on site by BA, allowing grids to be re-surveyed if necessary. Data were backed up onto an external storage device in the office and finally a remote server at the close of day.



## 6.6 Data Presentation and Processing

Only minimal processing of the dataset was undertaken, zero mean grid (de-stripe vertical), zero mean traverse (de-stripe horizontal), and de-spike. The data was clipped at  $\pm 3nT$ . Raw corrected and processed greyscale plots with raw corrected XY trace plots were produced for comparison ensuring that no anomalies were processed out of the original data set. An interpretation plan characterising the anomalies was produced drawing together the evidence collated from the greyscale and XY trace plots. All figures were tied into the National Grid and printed to an appropriate scale.

## 6.7 Software

Raw data were downloaded using Bartington software Grad601 and will be stored in this format as 'raw data'. The software used to process the data and produce the composites was DW Consulting's Archeosurveyor v2.0. Datasets were then exported into AutoCAD and placed onto the local survey grid. An interpretation plot was then produced using AutoCAD.

## 7.0 PRESENTATION OF RESULTS

The gradiometer survey grid was positioned to be larger than the area needed for the PV system to enable future surveys to be undertaken without being hindered by the magnetic properties of the solar array (Figures 1 and 2).

Two curvilinear anomalies present in the centre of the dataset are potentially of archaeological origin (figure 3, 4, 5, 6 and 7), recorded as weak positive anomalies that could also be of agricultural or geological origin. Located just to the north-west of the curvilinears and of similar strength is a positive discrete anomaly that may prove to be an archaeological pit, however an agricultural or geological origin cannot be ruled out.

Areas of magnetic disturbance are predominant in the dataset (Figure 7), with large areas present to the south and north-east. The area to the north-east contained a lot of landscaped soil, a bank had been built-up and a new tree plantation planted (Figure 1) that accounts for the 'noisy' readings. Magnetic disturbance in the south is present where rubbish had been previously stored by the farmer and is also close to a dump of slurry/manure.

Strong isolated dipolar responses or 'iron spike' anomalies were also common within the dataset. They are likely to have been caused by ferrous objects being introduced into the topsoil through agricultural manuring or remnants of the rubbish pit that was present on site.

A thin linear area of magnetic disturbance is located running perpendicular to the weak negative parallel linear anomalies that are aligned north-east to south-west. The magnetic disturbance has been interpreted as the location of a boundary and possible trackway that divides the two fields, and the weak negative parallel linear anomalies have been recorded where extant furrows and rows of planted onions are present.





## 8.0 DISCUSSION & CONCLUSIONS

Cropmarks associated with an Iron Age settlement are present to the north of the survey area, however anomalies likely to be of an archaeological origin are sparse within this dataset. Only two curvilinear anomalies and one discrete anomaly have the potential to be archaeological in nature.

Areas of magnetic disturbance are predominant within the dataset caused by recent agricultural activity that includes landscaping, rubbish storage and the introduction of foreign soil into the upper matrix. The agricultural furrows are also testament to the current land usage with numerous ferrous dipolar 'iron spike' anomalies likely to have been either introduced during manuring or are rubbish pit remnants.

It is possible that the large amounts of magnetic disturbance could have masked underlying weaker archaeological anomalies, plough truncation of archaeological features is also likely due to a modern ploughing regime undertaken over recent seasons.

The site has some archaeological potential, with three potential archaeological features present that may warrant further investigation. Multiple areas of magnetic disturbance caused by the impact of modern agricultural activity could be masking weaker small-scale, possibly truncated archaeological features.

## 9.0 ACKNOWLEDGMENTS

Britannia Archaeology would like to thank Ruth Goodfield of Mosscliff Environmental Ltd for funding the project.

We are also grateful for the advice of Dr Jess Tipper of SCCAS/CT.

## 10.0 PROJECT ARCHIVE & DEPOSITION

A full archive will be prepared for all work undertaken in accordance with guidance from the *Selection, Retention and Dispersion of Archaeological Collections*, Archaeological Society for Museum Archaeologists, 1993. Arrangements will be made for the archive to be deposited with the relevant museum/HER Office.

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English Heritage PastScape [www.pastscape.org.uk](http://www.pastscape.org.uk)

Archaeological Data Service (ADS) [www.ads.ahds.ac.uk](http://www.ads.ahds.ac.uk)

English Heritage National List for England

[www.english-heritage.org.uk/professional/protection/process/national-heritage-list-for-england](http://www.english-heritage.org.uk/professional/protection/process/national-heritage-list-for-england)

DEFRA Magic <http://magic.defra.gov.uk/website/magic>



## APPENDIX 1 – TECHNICAL DETAILS

### Magnetometers

The magnetometer differs from the 'active' magnetic susceptibility meter by being a 'passive' instrument. Rather than injecting a signal into the ground it detects slight variations in the Earth's magnetic field caused by cultural and natural disturbance (Clark).

Thermoremanent magnetism is produced when a material containing iron oxides is strongly heated. Clay for example has a high iron oxide content that in a natural state is weakly magnetic, when heated these weakly magnetic compounds become highly magnetic oxides that are detectable by magnetometer.

The demagnetisation of iron oxides occurs above a temperature known as the Curie point; for example haematite has a Curie point of 675 Celsius and magnetite 565C. At the time of cooling the iron oxides become permanently re-magnetised with their magnetic properties re-aligned in the direction of the Earth's magnetic field at the time of heating (Gaffney and Gater). The earth's magnetic field has changed over time but the direction in which the particles face will not. This change in magnetic field alignment can be detected by the magnetometer. A magnetometer can also detect where the magnetic field alignment of particles are aligned in random directions, for example accumulative deposits within ditches or rubbish pits.

Kilns, hearths, baked clay and ovens can reach temperatures of the Curie point, and are the strongest responses apart from large iron objects that can be detected. Cultural anomalies that can be detected by the magnetometers include occupation areas, pits, ditches, furnaces, sunken feature buildings, ridge and furrow field systems and ritual sites (David, 2011). Modern ferrous service pipes, field drainage pipes, removed field boundaries, perimeter fences and field boundaries can also be recorded.

### Fluxgate Gradiometers

Fluxgate gradiometers are sensitive instruments that utilise two sensors placed in a vertical plane, spaced 1 metre apart. The sensor above reads the Earth's magnetic (background) response while the sensor below detects the local magnetic field. Both of the sensors are carefully adjusted to read zero before survey commences at a 'zeroing' point, selected for its relatively 'quiet' magnetic background reading. When differences in the magnetic field strength occur between the two sensors a positive or negative reading is logged. Positive anomalies have a positive magnetic value and negative anomalies a negative magnetic value relative to the site's magnetic background. Examples of positive magnetic anomalies include hearths, kilns, baked clay, areas of burning, ferrous material, ditches, sunken feature buildings, furrows, ferrous service pipes, perimeter fences and field boundaries. Negative magnetic anomalies include earthwork embankments, plastic water pipes and geological features.

The instruments are usually held approximately 0.30m to 0.50m above the ground surface and can detect to a depth of between 1-2metres. Best practice dictates that the direction of traverse should be east to west, optimising the instruments data quality.



## **Magnetic Anomalies**

### **Linear trends**

Linear trends can be both positive and negative magnetic responses. If they are broad, relatively weak or negative in nature they may be of agricultural or geological origin, for example periglacial channels, land drains or ploughing furrows. If the responses are strong positive magnetic linear trends they are more likely to be of archaeological origin. Archaeological settlement ditches tend to be rich in highly magnetic iron oxides that accumulate in them via anthropogenic activity and humic backfills. Curvilinear trends can also be recorded and are indicative of archaeological structures such as drip-gullies.

### **Discrete anomalies**

Discrete anomalies appear as increased positive responses present within a localised area. They are caused by a general increase in the amount of magnetic iron oxides present within the humic back-fill of for example a rubbish pit.

### **'Iron spike' anomalies**

These strong isolated dipolar responses are usually caused by ferrous material present in the topsoil horizon. They can have an archaeological origin but are usually introduced into the topsoil during manuring.

### **Areas of magnetic disturbance**

An area of magnetic disturbance is usually associated with material that has been fired. For example areas of burning, demolition (brick) rubble or slag waste spreads. They can also be caused by ferrous material, e.g. close proximity to barbwire or metal fences and field boundaries, buried services, pylons and modern rubbish deposits.

### **Dataset Plotting**

As is traditional BA plot the positive anomalies in black and the negative in white on the greyscale plans, XY trace and interpretative AutoCAD plans are also plotted.



## APPENDIX 2 – OASIS SHEET

**OASIS ID:** *britanni1-129836*

### Project details

**Project name** *BML 039 Land and Buildings at Low Farm, Bridge Road, Bromeswell, Suffolk*

**Short description of the project** *A detailed magnetometer survey on approximately 1 hectare of land at Low Farm, Bridge Road, Bromeswell Suffolk (TM 307 515) in advance of the construction of a ground mounted photovoltaics (PV) system. Despite the high potential for anomalies of archaeological origin, only two curvilinear and one discrete pit type anomaly were present at Low Farm. Extant agricultural furrows were recorded to the south-west and areas of magnetic disturbance and iron-spike anomalies were abundant across large parts of the survey area alluding to the widespread modern agricultural activity and landscaping undertaken during recent years.*

**Project dates** *Start: 29-06-2012 End: 29-06-2012*

**Previous/future work** *Not known / Yes*

**Any project codes** *associated reference BML 039 - HER event no.*

**Any project codes** *associated reference P1007 - Contracting Unit No.*

**Type of project** *Field evaluation*

**Site status** *Local Authority Designated Archaeological Area*

**Current Land use** *Cultivated Land 4 - Character Undetermined*

**Monument type** *NONE None*

**Monument type** *NONE None*

**Significant Finds** *NONE None*

**Significant Finds** *NONE None*

**Methods & techniques** *"Geophysical Survey"*

**Development type** *Farm infrastructure (e.g. barns, grain stores, equipment stores, etc.)*

**Development type** *Solar PV Farm Array*

**Prompt** *Planning condition*

**Position in the planning process** *After full determination (eg. As a condition)*

**Solid geology (other)** *Red Crag Formation Sandstone*

**Drift geology** *GLACIAL SAND AND GRAVEL*



**Techniques** *Magnetometry*

**Project location**

**Country** *England*

**Site location** *SUFFOLK SUFFOLK COASTAL BROMESWELL Land and Buildings at Low Farm, Bridge Road, Bromeswell, Suffolk*

**Postcode** *IP12 2QB*

**Study area** *1.00 Hectares*

**Site coordinates** *TM 30705 51605 52 1 52 06 50 N 001 22 11 E Point*

**Lat/Long Datum** *Unknown*

**Height OD / Depth** *Min: 15.00m Max: 20.00m*

**Project creators**

**Name of Organisation** *Britannia Archaeology Ltd*

**Project originator** **brief** *Local Authority Archaeologist and/or Planning Authority/advisory body*

**Project originator** **design** *Tim Schofield*

**Project director/manager** *Matthew Adams*

**Project supervisor** *Timothy Schofield*

**Type of sponsor/funding body** *Developer*

**Name of sponsor/funding body** *Mosscliff Environmental Ltd*

**Project archives**

**Physical Exists?** **Archive** *No*

**Digital recipient** **Archive** *Suffolk HER*

**Digital Contents** *"none"*

**Digital available** **Media** *"Geophysics", "Text"*

**Paper recipient** **Archive** *Suffolk HER*

**Paper Media available** *"Report", "Unpublished Text"*

**Project bibliography 1**

**Publication type** *Grey literature (unpublished document/manuscript)*

**Title** *Land and Buildings at Low Farm, Bridge Road, Bromeswell, Suffolk: A Detailed Magnetometer Survey*



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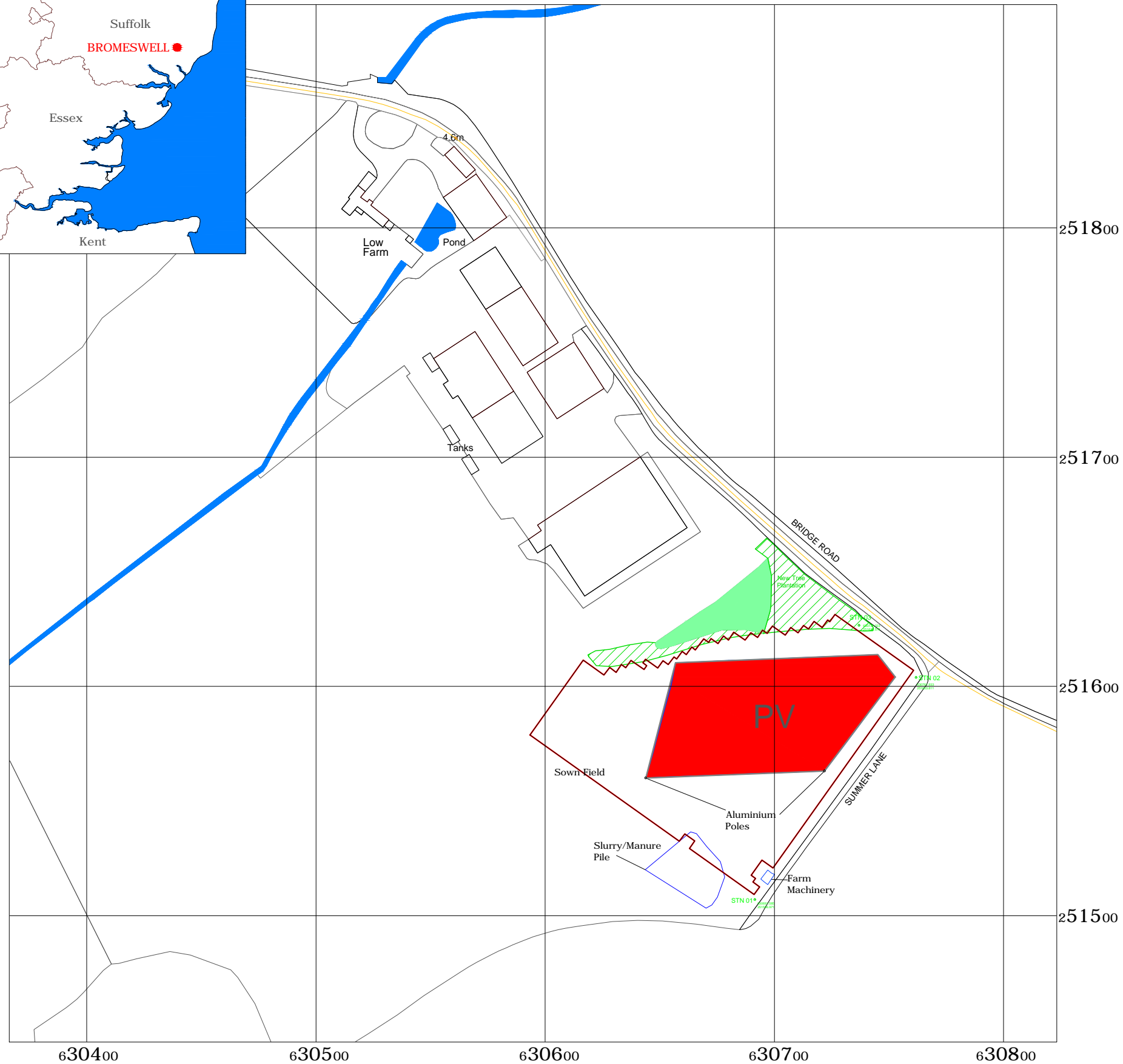
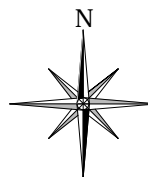
**URL** <http://www.britannia-archaeology.com>

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**Entered on** 7 July 2012

**OASIS:**

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 Solar Panel Proposed Location

NGR: **TM 307 515** Site Code: **BML 039**

PROJECT:  
**LAND & BUILDINGS AT LOW FARM,  
BRIDGE ROAD, BROMESWELL,  
SUFFOLK**

CLIENT:  
**RUTH GOODFIELD**

DESCRIPTION:  
**SITE & PV LOCATION PLAN**

**BRITANNIA ARCHAEOLOGY LTD**



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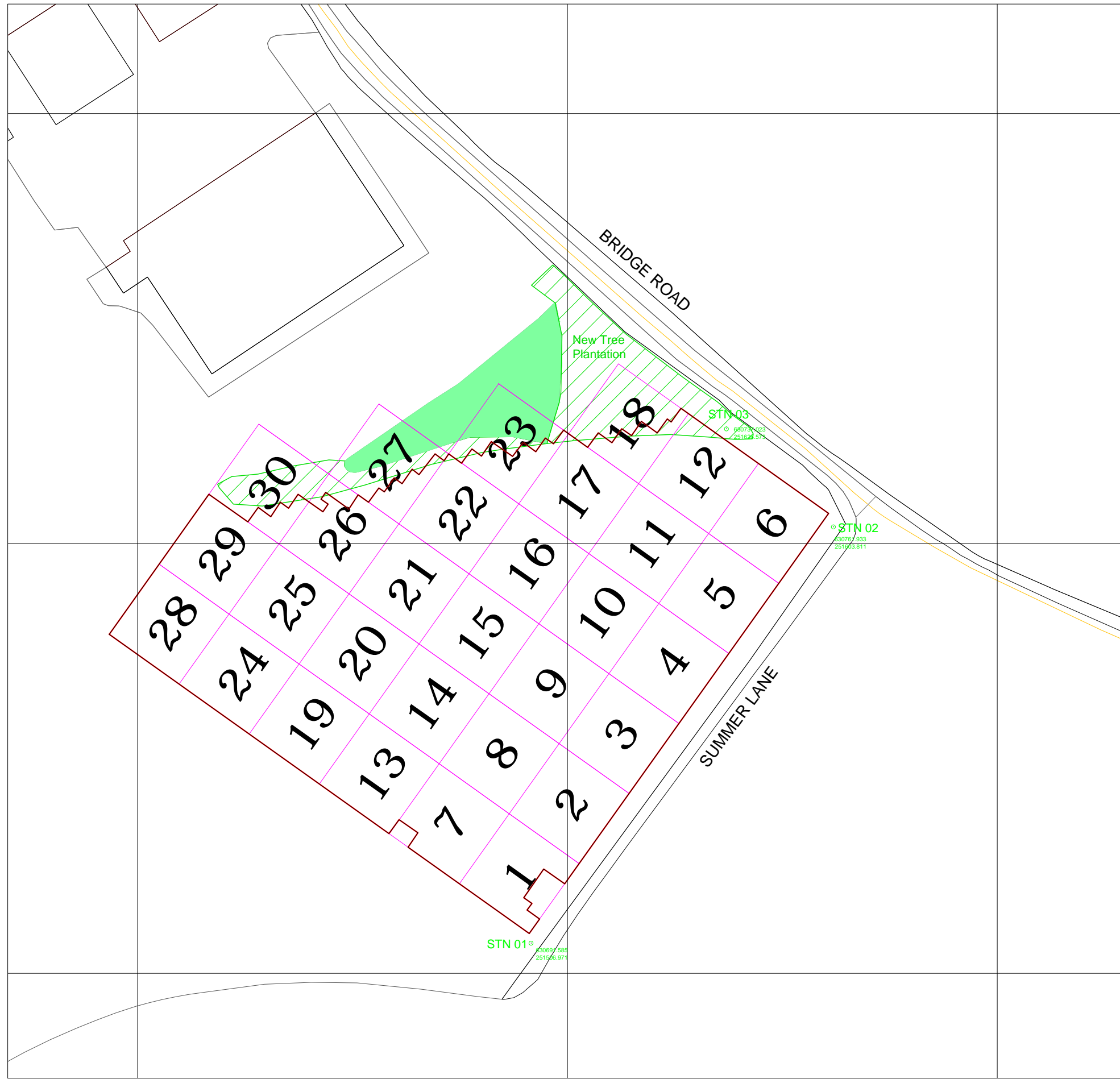
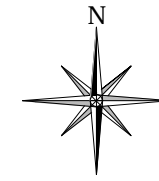
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SCALE: **1:2000** 

PLOT: <b>A3</b>	APPROVED: <b>MCA</b>	VERSION: <b>01</b>
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DATE: <b>JULY 2012</b>	AUTHOR: <b>TPS</b>	FIGURE: <b>01</b>
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STATION	EASTING	NORTHING
01	630737.023	251626.573
02	630761.933	251603.811
03	630691.585	251506.971

◉ STN 02 Reference Station Location

▣ Survey Grid Location

NGR: TM 307 515 SITE CODE: BML 039

PROJECT:  
LAND & BUILDINGS AT LOW FARM,  
BRIDGE ROAD, BROMESWELL,  
SUFFOLK

CLIENT:  
RUTH GOODFIELD

DESCRIPTION:  
SURVEY GRID LOCATION &  
REFERENCE STATION PLAN

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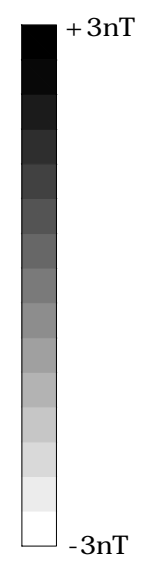
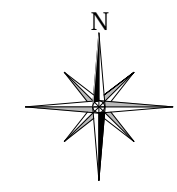
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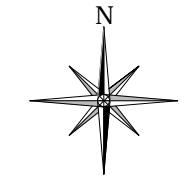
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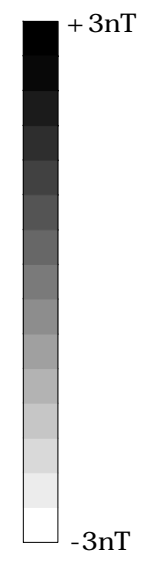
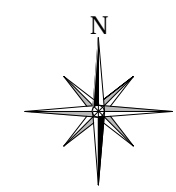
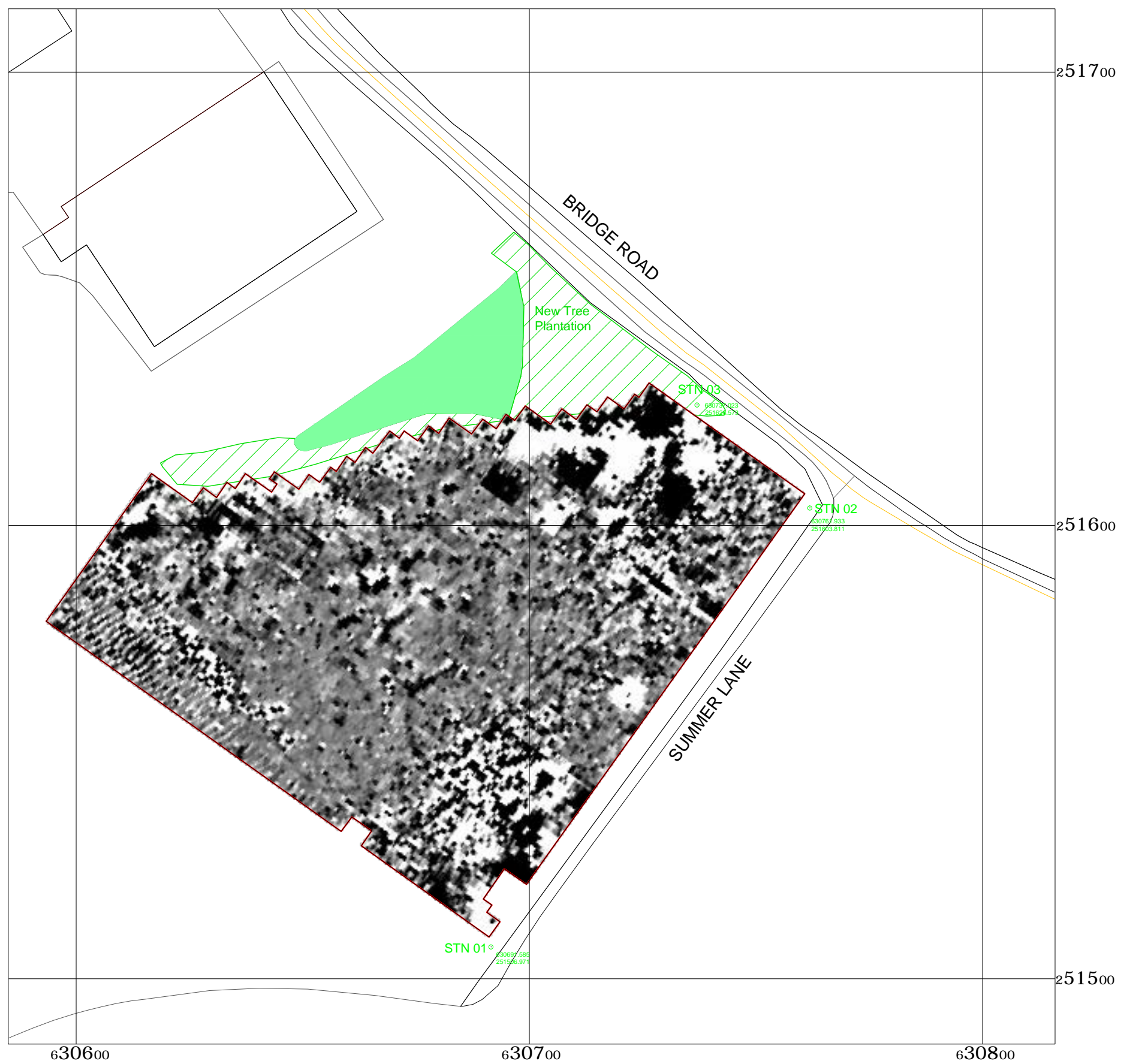
NGR: TM 307 515	SITE CODE: BML 039
PROJECT: LAND & BUILDINGS AT LOW FARM, BRIDGE ROAD, BROMESWELL, SUFFOLK	
CLIENT: RUTH GOODFIELD	
DESCRIPTION: RAW CORRECTED GREYSCALE GRADIOMETER DATA PLOT	
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SCALE: 1: 1000	
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PLOT: A3	APPROVED: MCA	VERSION: 01
DATE: JULY 2012	AUTHOR: TPS	FIGURE: 03

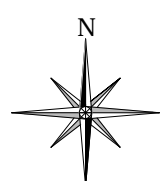


8nT/cm		Scale Interval	
NGR: TM 307 515		SITE CODE: BML 039	
PROJECT: LAND & BUILDINGS AT LOW FARM, BRIDGE ROAD, BROMESWELL, SUFFOLK			
CLIENT: RUTH GOODFIELD			
DESCRIPTION: RAW CORRECTED GRADIOMETER XY TRACE PLOT			
BRITANNIA ARCHAEOLOGY LTD			
			
4 THE MILL, CLOVERS COURT, SUFFOLK IP14 1RB  T: 01449 763034 E: info@britannia-archaeology.com www.britannia-archaeology.com			
SCALE: 1:1000			
PLOT: A3	APPROVED: MCA	VERSION: 01	
DATE: JULY 2012	AUTHOR: TPS	FIGURE: <b>04</b>	

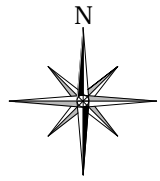
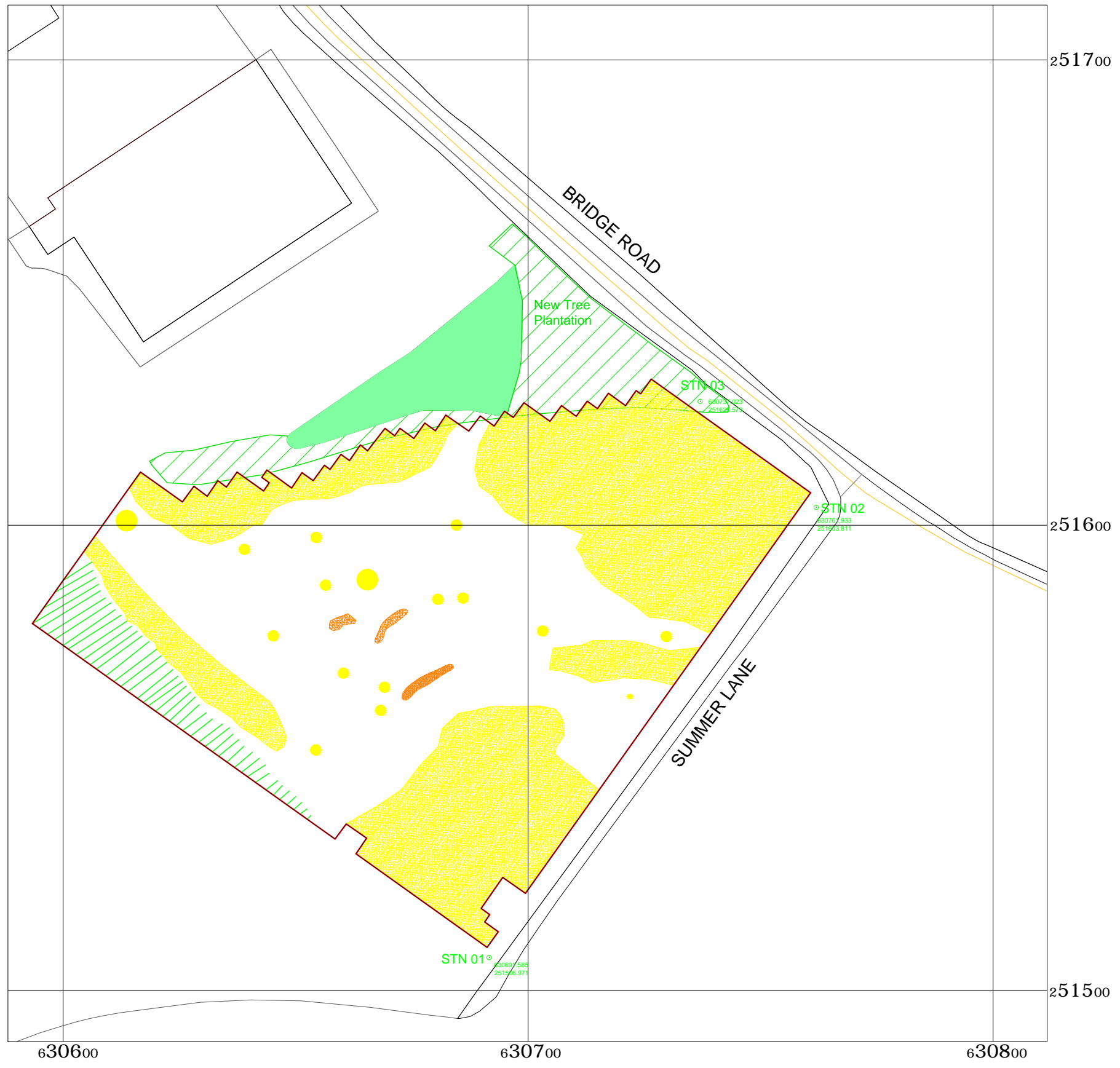







NGR: TM 307 515	SITE CODE: BML 039
PROJECT: LAND & BUILDINGS AT LOW FARM, BRIDGE ROAD, BROMESWELL, SUFFOLK	
CLIENT: RUTH GOODFIELD	
DESCRIPTION: PROCESSED GRADIOMETER GREYSCALE DATA PLOT	
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SCALE: 1:1000		
PLOT: A3	APPROVED: MCA	VERSION: 01
DATE: JULY 2012	AUTHOR: TPS	FIGURE: 05



8nT/cm	Scale Interval	
NGR: TM 307 515	SITE CODE: BML 039	
PROJECT: LAND & BUILDINGS AT LOW FARM, BRIDGE ROAD, BROMESWELL, SUFFOLK		
CLIENT: RUTH GOODFIELD		
DESCRIPTION: PROCESSED GRADIOMETER XY TRACE PLOT		
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4 THE MILL, CLOVERS COURT, SUFFOLK IP14 1RB  T: 01449 763034 E: info@britannia-archaeology.com www.britannia-archaeology.com		
SCALE: 1:1000		
PLOT: A3	APPROVED: MCA	VERSION: 01
DATE: JULY 2012	AUTHOR: TPS	FIGURE: 06



	Linear Anomaly, Agricultural
	Area of Magnetic Disturbance, Ferrous Material
	Isolated Dipolar Anomaly, Ferrous Material
	Positive Curvi-Linear Anomaly, Archaeology?
	Positive Discrete Anomaly, Archaeology?

NGR: TM 307 515	SITE CODE: BML 039
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PROJECT:  
LAND & BUILDINGS AT LOW FARM,  
BRIDGE ROAD, BROMESWELL,  
SUFFOLK

CLIENT:  
RUTH GOODFIELD

DESCRIPTION:  
INTERPRETATION PLOT OF  
GRADIOMETER DATA

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www.britannia-archaeology.com

SCALE: 1: 1000	
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PLOT: A3	APPROVED: MCA	VERSION: 01
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DATE: JULY 2012	AUTHOR: TPS	FIGURE: 07
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